

Fake Product Review Analysis and Monitoring

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Submission date: 17-Mar-2020 11:19AM (UTC+0530)

Submission ID: 1276904797

File name: Fake_Product_Review_Analysis_and_Monitoring.pdf (339.75K)

Word count: 3358

Character count: 17512

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Abstract—One of the most difficult and hard problems that a lot of e-commerce sites face today is the presence of an abundance of fake reviews by malicious users. This is usually done to eradicate competition. Currently there are no datasets to find out the fake reviews in a flawless way. So, we intend to use unsupervised machine learning with the help of cloud computing to fabricate an efficient fake review analysis monitoring system. To achieve this goal, preprocessing of data must be done to ensure that there is no flaw in the input data. It is a very important step as any error in the data will ultimately cause an error in the analysis. Once the processing of data is done, the reviews are analyzed in several stages including Stemming, Bag of words method and Tokenization. These techniques facilitate in the detection of fake reviews. Online reviews play a pivotal role in online shopping as customers tend to see reviews before deciding to buy any product and hence fake reviews are a major concern. So, it is very important to remove these Deceptive reviews that are posted on the e-commerce websites and help customers avoid falling for the trap by showing them only the genuine reviews.

Keywords— Random Forest Classifier, Bag of Words, Fake, Review, Products, Corpus.

I. INTRODUCTION

In today's world, the growth rate of data has become exponential. E-commerce sites such as amazon receive large amounts of data in the form of user reviews. These reviews are an integral part of an e-commerce site as it has the ability to make or break the sales of a product. This is mainly due to the fact that reviews and star ratings have a massive impact on customers and dictates if the customer will buy the product or not. But one major loophole that competitors have exploited is the submission of paid deceptive and fake

reviews through the use of bots and many other ways consequently affecting sales of the product. These immoral actions are usually done by competing organizations or hackers. In order to prevent this, we have decided to create a solution for this problem with the help of Machine Learning. The fake product review analysis systems before have only been done by data or opinion mining. But we have decided to use Random Forest Classifier instead.

II. LITERATURE REVIEW

A. Existing System Analysis

Due to the several processes involved, the already existing systems take up more memory and time, than the optimum amount, in order to analyze the review which in turn affects the efficiency of the system. The current efficiency of the system does not keep up with the fast-paced world. Due to the lack of speed the fake reviews can be seen by the customer by the time it can be detected and removed. Though these fake reviews are online only for a small period of time the impact they have can be vastly polarizing.

B. Opinion Mining

Starting with the categorization on various types of reviews: opinion false reviews are of two types. Positive for upgrading the sales of product and negative for degrading the sales of the product. Reviews on brands by the sole company to upgrade the product despite viewing the quality, non-reviews which are not related to product itself but posted by system generated software. [1] Detection of spams depending on the overall rating of the product, group of fake reviews in a continuous manner and online review manipulation in

graphic format. [2] Starting with tracking an IP address of the reviewer, if multiple reviews are from the same source then it is considered to be fake. Reviews on brand only are also considered because the value of brand can't play a role in defining the genuineness of any product. [3] A pool of words which are categorized as positive for a real review and negative for a spam review, if such words are identified then the results are straightforward. [4] Starting with the drawbacks of existing models, distinguishing between fake and real reviews. User verification while writing a review which makes it easy for the admin to understand the polarity of the review. Here, the reviews are initially categorized into different forms. Namely, False reviews, Brand reviews and Spam review. Then, the deviations present in the ratings recorded are comprehended into a particular form. Then the sentiment analysis of the product review is done after IP address detected. Firstly, the User IDs for the admins are verified. The reviews are then deleted or posted by the admins once the verification is done. [5] Finally, using the review polarity technique, the reviews are analyzed and then in the end, they are categorized as genuine or fake. Similar to the one previously mentioned, this paper also performs tracking of IP address initially. [6] Then, the accounts that were used to write the reviews are identified. Further, the reviews that are identified are divided into different types. Again, the main drawback of following this technique is consumption of time. If not for the various steps present, the time taken which is high here could have been reduced by optimizing and reducing the number of modules present. Finally, the negative words are removed and the spam reviews are classified.

C. Data Mining

Starting with research and survey and finding the drawbacks in the existing approaches, finding new strategies and solutions on how to extend in order to overcome the drawbacks. Creating a dataset from random records on available websites. [8] Combining the records collected into a coherent form. Separating the spam and non-spam reviews on the basis of preprocessing techniques like tokenization, stemming, etc. [9] Evaluating on the basis of approaches and conveying a final result. Survey conducted for the public to get a brief knowledge about the perspective of reviews on products. Starting with data cleaning using various programming languages. Sentiment analysis and prediction on different types of reviews. Fake review detection by performing machine learning algorithms like Naive Bayes, linear regression. [10] Statistical analysis of reviews which makes the product valuable for the customers or not. Here,

sentiment analysis has been used to analyzing of the review. That is, the final outcome will be in the range of -1 to +1, a polarity wise categorization process. [11] But the specific nuances of the review cannot be handled using Sentiment Analysis making this method not optimally efficient in terms of determining if the review is fake or real. [12] Furthermore, Naïve Bayes and Decision Tree algorithms are also used. Here, the dirty dataset is firstly cleaned using various programming languages. The reviews are then analyzed using sentiment analysis. The analyzed reviews are further classified on the basis of genders. [13] The classified data is put in a testing classified and then the accuracy of the testing is determined. The processes performed are visualized neatly with the help of data visualization plots and graphs and in the end a statistical analysis is performed.

D. Sentiment Analysis

Starting with the data mining process to scrutinize and store huge amounts of data and find different range of patterns related to the data. NLP for analyzing the opinions of the public depending on the text or numbers written on their reviews. Web scraper for scraping out the required content from the website. [14] Preprocessing techniques used to filter the reviews based on spam and non-spam category. Sentiment analysis for identification of fake reviews and content similarity for giving polarity to a particular review. Similar to the one previously mentioned, this paper also performs tracking of IP address initially. Then, the accounts that were used to write the reviews are identified. [15] Further, the reviews that are identified are divided into different types. Again, the main drawback of following this technique is consumption of time. If not for the various steps present, the time taken which is high here could have been reduced by optimizing and reducing the number of modules present. Finally, the negative words are removed and the spam reviews are classified.

III. PROPOSED METHODOLOGY

A. General Overview

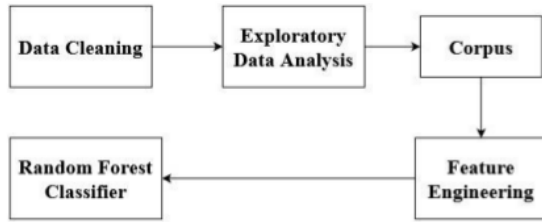


Fig. 1: Proposed Methodology

1) *Data Cleaning*: Data cleaning is the process where all the null or corrupted values in the csv/xlsx file that we imported are modified or removed. These reviews are modified when the null values are huge in number or completely removed when the null values are only negligible in number.

2) *Exploratory Data Analysis*: In this step, in order for us to know about the data we are handling, visualization of the dataset is done using python visualization libraries.

3) *Corpus*: Punctuation, Stop-words and stemming are performed to form a corpus which in turn is used to in formation of bag of words.

4) *Feature Engineering*: Feature engineering is the process of extracting data and converting them in a format where the machine learning model can understand. Here, we convert of all the string values into numbers for faster training.

5) *Random Forest Classifier*: In this step, the system is trained to spot fake reviews using a Random Forest Classifier Machine Learning Model. This is done with the help of the feature engineered training and test data.

B. Data Cleaning

At first when we receive the data from the customer in the form of a csv file or a html file, we use the read_csv/read_html function using required library in python to assign the contents of the file as a data frame. If the file is considered to have clean data then we can go to the next step otherwise we must use a heatmap to find out the columns which have a large number of null values. Box plots are used to find the categorical mean of the values which are consequently assigned to the null values based on their categorization. Once data is cleaned, both the residual null values and the unwanted columns are removed and the final dataset is attained.

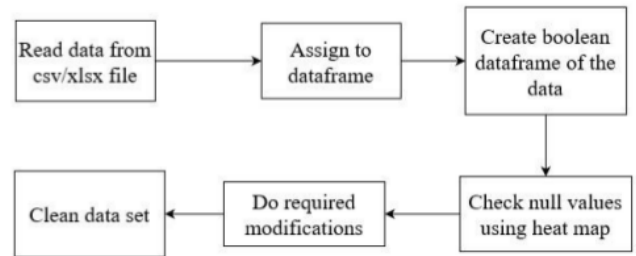


Fig. 2: Data Cleaning Block Diagram

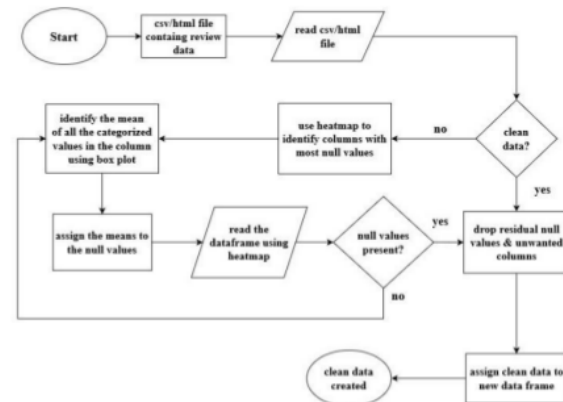


Fig. 3: Data Cleaning

C. Exploratory Data Analysis

Exploratory Data Analysis (EDA) is method of analyzing datasets. It helps in summing up the overall view of the entire dataset, often with visual representation. This is technique commonly used by analysts to convey their findings in a clearly understandable format. EDA is commonly done with the help of plots and there are several plots to choose from for unique requirements. Boxplot, Histogram, Scatterplot and Box and Whiskers plot are some of the common types are plots that we use.

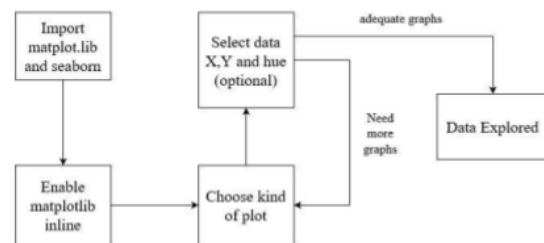


Fig. 4: Exploratory Data Analysis

D. Corpus

Corpus in general is considered as a sentence whose punctuations, stop words, prefixes as well as suffixes are

removed. This method is usually done when dealing with Natural Language Processing which uses the bag of words model. The main purpose of making a Corpus is to make the machine learning model more efficient courtesy of the removal of unwanted words and characters.

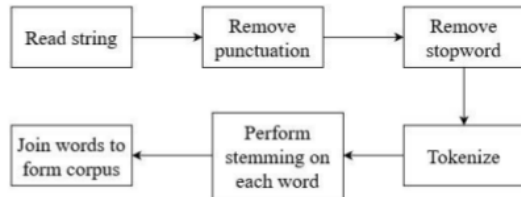


Fig. 5: Corpus Creation

1) *Tokenization*: The first basic step in preprocessing data before feeding it into our system is Tokenization. This step is followed in every text classification engine as it helps in reducing the processing time when we train the data. Tokenization involves breaking down of character into individual words called tokens and removing punctuations. Example for Tokenization:

Input Text: 'A group of top ranked anime villains combined is called Espada.'

Output Text:
['A','group','of','top','ranked','anime','villians','combined','is','called','Espada']

This process can now be easily performed in Python by using the .split() function. The next step of Tokenization is Stop-Word Elimination.

2) *Stop-Word Elimination*: Once the characters are broken down into tokens, the next step is Stop-Word Elimination. In this step, all the negative stop words including pronouns, conjunctions and prepositions in the sentence are removed. This is done to reduce the number of words in the text fed into the system without affecting the overall meaning of the sentence, thus in turn reducing the time required for processing when training the data.

Example for Stop-Word Elimination:

Input Text:
['A','group','of','top','ranked','anime','villians','combined','is','called','Espada']

Output Text:
['group','top','ranked','anime','villians','combined','Espada']
Stop-words are removed with the help of 'stopwords' package from nltk.corpus in Python. This package consists of the set

of stopwords which if present in the sentence are removed.

2) *Stemming*: Stemming is the process of reducing a word to its root by removing prefixes and suffixes in the word. For instance, let us take three words 'study', 'studying' and 'studied', we humans know that these three words have the same meaning but that is not the case with a machine. For a computer, these three words have different meanings, so to correct this conundrum, we use the process of stemming. Stemming converts these three words into 'studi' so that the computer can take them as one word



Fig. 6: Tokenization and Stop-word elimination

E. Feature Engineering

Feature engineering is the extraction of data and converting them in a format where the Machine Learning Model can understand. Here, we convert of all the string values into numbers for faster training.

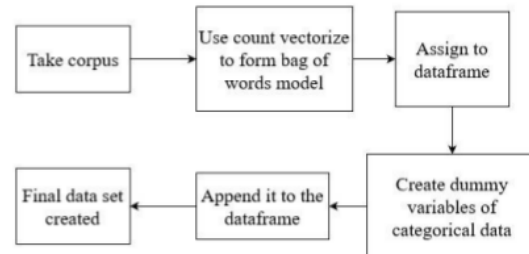


Fig. 7: Feature Engineering

1) *Bag of Words Model*: Now that the stop-words are

removed, the next step is called the Bag-of-Words Model, or the BoW Model. Until now, beginning from the text being very messy, tokenization was done to break them down and then the negative stop-words were then removed. Now, the BoW model involves calculating the sentence wise frequency of the words present in the whole dataframe. This is like giving a subjectivity score to the text data. That is, a word is a feature in the ML standpoint. Bag-of-Words is implemented using the concept of sentence_vectors with the help of the nltk package in Python.

Example for Bag-of-Words Model:

```
[ 'group' = 1, 'top' = 1, 'ranked' = 0, 'anime' = 1, 'villians' = 1, 'combined' = 0, 'Espada' = 1 ]
```

```
"group anime combined" = [1, 1, 0, 1, 0, 1, 1]
```

```
"top ranked combined" = [1, 0, 0, 1, 1, 1, 1]
```

Since the output data is in the form of Boolean values, the processing time and complexity during training of data is very much lower when in comparison to when the output data is in the form of text or string.

2) *Dummy Variables Creation*: Dummy variables are used to convert categorical data into a Numerical Dataframe. This dataframe is then added to the Bag of Words Model Dataframe to form the Final Dataset.

F. Random Forest Classifier

Random Forest Classifier is an ensemble of several independent decision trees that work together to make the predictions required. This is an upgraded version of the normal decision tree model. Each decision tree gives a prediction and the prediction with the highest number will become our final prediction value. Thus, making the required prediction. This is the most efficient way to do binary classification.

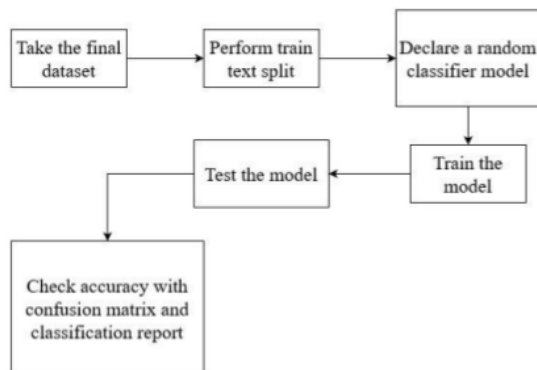


Fig. 8: Random Forest Classifier

IV. RESULTS AND ANALYSIS

We fit the data in the classifier and tested the accuracy of the classifier using precision score, recall score, f1-score and predpipe score. We tested the classifier for Shoes category and the results obtained for the data fitted for fake and real reviews are as follows. The precision scores are 0.95 and 0.87 respectively. The recall scores are 0.89 and 0.95 respectively. The f1 scores are 0.92 and 0.91 respectively. The support scores are 116 and 94 respectively. Thus, proving the accuracy for the classifier that has been fit.

V. CONCLUSION

Through this paper we detect the presence of fake reviews in online shopping website. This is done with the help of Random Forest Classifier. We chose Random Forest Classifier over other methods like Sentiment Analysis and Opinion mining due to the time effectiveness it shows dominating the latter two. Processes of Corpus creation, Feature engineering and Bag of words model have helped in achieving the time effectiveness needed. The model gives an accuracy ranged from 75-95% depending on the product category that the user wants to choose from. The accuracy of the detection of fake reviews are solely based on the product type itself and their variants. This will allow users to choose from the particular category that will want their reviews from.

VI. FUTURE ENHANCEMENT

In the future, we have planned to make this project more dynamic. Currently, we use an already existing dataset and our findings and analysis are derived from that particular dataset. In the future, we plan to make it more dynamic by allowing the user to choose the website URL on their own from a product they wish to buy directly from Amazon. They will have to copy and paste the URL, from which the analysis of data will be done and the real and fake reviews will be detected. Thus, providing analysis of real-world data. This can be done with the help of a python Library called scrapy which will parse and scrap webpages on its own if provided the URL, thus making our project more dynamic. Further, we are planning on making our code as an extension that can run on any browser. Here the extension or add-on, when we reach a particular e-commerce site, automatically scans the page and shows the amount of real and fake reviews that are present. Thus, making the process much more trivial for users to make use of.

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